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ABSTRACT

Traditional approaches to the cost analysis of educational programs involve examining annual budgets. Such approaches do not properly consider the cost of either new capital expenditures or the current value of previously purchased items. This paper presents the methodology for a new approach to educational cost analysis that identifies the actual resources (staff, equipment, and the like) used in the program and then estimates the cost of those resources. (Author/IRT)

# EDUCATIONAL COST ANALYSIS

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## INTRODUCTION

The cost of educating our children is very expensive. It has been estimated that 90 billion dollars was spent in 1973 for all levels. This represents approximately 8 percent of our gross national product. State and local governments alone provided 57 billion dollars. This amount of money represents approximately 62 percent of all the money they spend in the social areas. Despite this staggering sum, the success of our educational system is being questioned. More importantly, taxpayers no longer appear willing to accept the principle that the more money that is spent on education, the more successful the program will be.

As a reflection of this fact, cost is becoming an important consideration in the evaluation of educational programs. Often, there are wide variations in the cost of implementing and operating such programs, while the differences in their success are relatively small. It is critically important to know accurately these costs. If two programs produce the same level of success, the less expensive program is the obvious choice. Even if a more expensive program is shown to be more successful, it is important to know the cost of its success.

Herein, however, lies the problem. Meaningful cost data is simply not available. Reports such as the Commission on Instructional Technology's To Improve Learning and the Ford Foundation's An Inquiry into the Uses of Instructional Technology not only have documented the lack of the cost data necessary for making decisions about the cost-effectiveness of using various educational programs, but have also demanded that such information be obtained.

It is the purpose of this paper to discuss both the role of cost analysis in the evaluation of educational programs, and the inadequacies of the currently used procedures. The paper then presents the methodology for a new approach in educational cost analysis which overcomes these limitations.

## OBJECTIVES OF EDUCATIONAL COST ANALYSIS

There are really two distinct and different users of educational cost analysis. The first, and most obvious, is the local school administrator who is faced with a decision as to which kind of program to implement to improve his schools. He may have available to him studies of the costs of the several programs he is evaluating. However, they may not really be that useful to him in making this decision. For example, one program under consideration may require a great deal of instructional space. Because of the high cost of construction, this program may be reported as being relatively more expensive. However, the administrator may have available space which is unused because of a decline in school enrollment. Thus, the cost to this district would be less than that reported. In addition, the reported costs cannot accurately reflect the wage and overhead rates paid by this district. Rather than simple cost estimates, the administrator really needs a list of the resources required by the programs. These resources include the staff, facilities, equipment, and materials which must be available to properly implement the various programs. By examining this list, the administrator can identify the additional resource that he must obtain. By using his own cost rates, he can calculate the actual additional or incremental cost he must pay for the programs. These incremental costs provide a more meaningful cost comparison on which to base his decision.

The second use of cost analysis involves the examination of programs in a number of different districts in an effort to identify which programs are successful. These examinations, paid for from both private and public funds, represent the educational research being conducted today. It is the goal of this research to provide suggestions and recommendations as to which types of programs to replicate in schools. The incremental

costs used by the local administrator is not a valid basis for comparison in such an analysis. First, once a program has been implemented, it is nearly impossible to separate which resources were inherited from those which were purchased for the program. Second, even if such a separation could be made, there is no reason to assume that the schools in which the programs would be replicated would have the same inherited resources. For this reason, cost analyses conducted in education research should identify all the costs of the resources required by the various programs. In addition, the costs of the various programs must be calculated in a manner which allows a direct comparison between districts. Thus, corrections must be made for local variations in cost. In other words, a cost analysis conducted as part of an educational research project, to be meaningful as a basis of comparison, must develop its costs so as to eliminate the impact of the differing characteristics (such as labor rates and inherited resources) of the school districts in which these programs just happened to be observed.

The results of a cost analysis conducted as part of an educational research project are quite different from that conducted for a local school administrator. The estimated costs for the same project will actually be different. They are designed that way because of their different use. The research cost estimate is designed to allow recommendations to be made in general situations, while the latter cost estimate is designed to allow recommendations in specific situations. To be truly useful, a costing methodology should be capable of meeting both requirements.

## CURRENT COSTING PROCEDURES

Historically, cost estimates of educational programs have been based on budgetary information supplied by the school districts. By far the biggest problem associated with the use of such budget data is that, for the most part, school districts' budgets do not separately identify costs for individual programs. To use district-wide budget costs as an estimate of true cost implies that resources are used uniformly throughout a school or district. Usually, this implicit assumption is not correct.

Educational programs, particularly those examined during evaluations, quite often concentrate school resources in an effort to assist a small target population. Average costs based on budget data tend to obscure the true cost of these concentrated resources. Even where budgets are designed to give the cost of the concentrated resources, they usually only indicate the amount of money that is provided from a source other than the local school district.

This is particularly true for ESEA Title I funds. Federal law requires that an accurate accounting be made of these expenditures. There is thus usually a readily available budget cost for such programs. Since federal funds are supposed to be used to supplement the local funds, rather than replace them, it may be a justifiable argument that such a budget cost represents the incremental cost of implementing a program. Whatever the validity of this argument, the use of incremental costs as a basis for evaluating the relative cost of programs across school districts is not appropriate. As was discussed in the previous section, incremental costs reflect differences in factors such as the inherited resources and the labor rates of particular districts more than they reflect inherent differences in the programs in these districts.

There are other limitations to budgets as the basis for making cost estimates. The most obvious is that there is no assurance that program costs in different districts are computed in a comparable way. Different accounting procedures and cost allocation rules tend to create artificial cost differences. Regional differences in the cost of living causes tremendous differences in true cost of programs. It is simply not acceptable to compare directly the costs from the urban northeast to the costs from the rural south. In addition, the use of budgetary cost data does not properly include one-time capital expenses such as the cost of designing the program, or the purchase of new equipment. If the evaluation is conducted during the first year of a program when the majority of these one-time expenses are incurred, the evaluation will be distorted because the estimated costs will be higher than they should be. On the other hand, if the evaluation is conducted during subsequent years, the value of these capital expenditures, which are a true part of the cost of the program, will not be included at all.

## RESOURCE APPROACH TO COST ANALYSIS

A more appropriate technique for estimating the cost of individual programs is by determining the quantity of all the resources actually used in a program, and then estimating the cost of these resources. In principle, this technique, called the resource approach to cost analysis, is simple and straightforward. It is based on a process of identifying what resources are being used in a program, and an accounting of how much of these resources are being used. A partial list of some typical kinds of resources that might be considered is shown in Table 1.

Once the resources have been identified and counted, the actual program costs are calculated through the use of unit costs for each resource. Unit cost is defined to be the cost of one unit of a resource, such as the cost of one tape recorder or one teacher. Associated with each resource are two different types of unit cost: the capital investment cost and the annual operating cost. Capital investment costs are one-time expenditures needed for the initial implementation of a program. These include costs for new facilities, equipment, and the initial training of staff. Annual operating expenses are the costs needed each year to operate and maintain a program. They include the expenses for salaries, in-service training, materials and supplies, and equipment and facilities maintenance. The primary distinction between these two types of unit costs is the length of time benefits are derived from each type of expenditure. The services and benefits purchased by the annual cost are consumed in that year. The benefits of capital expenditures last over several years.

As pointed out in the previous section, one of the faults of the use of budget costs is that they generally do not consider the fact that capital expenditures have value over several years. If all the capital costs of a program were added to its annual operating cost, a fairly accurate estimate of the cost of the first year of operation would be developed. However, it would grossly overestimate the real cost of the program over time. On the other hand, to use only the annual operating cost would underestimate the true cost of a program, particularly for programs with high capital expenditures. The problem of dealing with

Table 1

TYPICAL RESOURCES

Staff

- Teacher
- Teacher Aide
- Reading Specialist
- Principal
- Secretary

Facilities

- Classrooms
- Offices

Materials

- Textbooks
- Library Books
- General Supplies

Equipment

- Tape Recorders
- Record Players
- Televisions
- Slide Projectors
- Movie Projectors
- Reading Machines

District Services

- Learning Centers
- Instructional Materials Centers

capital expenditures is only compounded by the fact that capital expenditures are sometimes spread over a number of years.

A solution to the problem of treating capital expenditures is to consider the value of the resource consumed in a particular year as the equivalent annual cost of that capital expenditure. Assuming that a resource (for example, a tape recorder) has little monetary value when it is eliminated, it is reasonable to estimate its cost of annual use as its capital cost divided by its average useful life. However, it may be more appropriate, from an economic analysis standpoint, to also consider the time value of money used for capital purchases. Capital purchases are usually made using borrowed money which must be paid back over time including interest. Considering the time value of money, the capital cost can be amortized over its useful life by using the following formula:

$$\text{Equivalent Annual Capital Cost} = \text{Capital Cost} \cdot \left[\frac{i\,(1+i)^n}{(1+i)^n - 1}\right], \quad (1)$$

where n = useful life in years, and
i = annual interest rate.

While the principles involved in the resource approach to cost analysis is relatively straightforward, the implementation of these principles is sometimes complex. By far the biggest problem is the fact that resources are often shared between programs, grades, and classrooms. For example, it is possible that two teacher aides assist all the classes in grades 1 and 2 for both reading and math. It is usually true that there is only one or two movie projectors in an entire school. Thus, it is not generally true that integer numbers of resources are assigned to a particular program. It is more common that the quantity of resources available is some fraction of a resource. For example, a program might have available the equivalent of half an aide and a quarter of a tape recorder.

For this reason, the basic methodology used in the resource approach employs the following functional form:

$$\text{Program Cost} = \Sigma\, n_i\, p_i\, c_i, \quad (2)$$

where $n_i$ = the total quantity of resource i available in the school,
$p_i$ = the proportion of resource i used in a particular program, and
$c_i$ = the unit cost of resource i considering both the annual operating cost and the equivalent annual capital cost.

The procedure, exemplified by equation (2), involves first determining the total quantity of each resource in a school. Each resource is then examined separately to determine the manner in which the various programs, classes, and grades share this type of resource. Based on the amount of time the resource is used by each program, the program allocation factor, $p_i$, is calculated. The product $n_i\ p_i$ is calculated as an estimate of the quantity of a resource available to the program. Finally, the unit cost of the resource is estimated considering both the annual operating cost and the equivalent annual capital cost. The product $n_i\ p_i\ c_i$ is calculated as the cost of this resource. The sum of all the costs of each resource is added to determine the total program cost.

## STRENGTHS AND WEAKNESSES OF THE RESOURCE APPROACH

The major strength of the resource approach to cost analysis is the fact that it is built on a foundation involving the actual resources employed in a program. It was designed primarily for use in educational research. It is ideal for such research because it examines the intrinsic differences in the actual resources employed in the programs. By using the same unit costs for a resource in all districts, the impacts of local and regional variations in labor rates and accounting rules are eliminated. These unit costs, called standardized costs, are based on national averages. The resulting program cost estimates thus give a reasonable national picture of the cost of a program.

In addition, the costs estimated by this approach can be more effectively used by the local school administrators. Because the basis of the approach is a detailed list of the resources employed in a program, he can quickly determine the list of incremental resources that will be required to implement the program in his district. Rather than using the standardized unit costs developed as part of the educational research project, the administrator can use the actual unit costs that he will have to pay for

the incremental resources. Thus, without a great deal of effort on his part, he can estimate the actual incremental cost of implementing the program. In other words, the resource approach to cost analysis is compatible to the needs of both educational research and the local administrators.

The major weakness of this approach is the volume of data required to effectively use the approach. A review of several current educational cost analyses[1,2,3] will show this to be true. In the study of compensatory reading programs, a total of 97 different resources were examined in 250 schools and over 2,000 classrooms around the nation. This volume and level of data requires large data collection efforts and massive amounts of data processing. Currently, cost analyses are being conducted on a second study of compensatory education and on the Follow Through program. Efforts are being made to reduce the data requirements.

Despite the problems associated with data collection and data processing, the resource approach to cost analysis is the only technique that has been developed with accurate estimates of the cost of educational programs on a meaningful and comparable basis.

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